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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/603,147 06/23/00 MOORE

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WELLS ST JOHN ROBERTS GREGORY AND MATKIN
SUITE 1300
601 W FIRST AVENUE
SPOKANE WA 99201-3828

EXAMINER

KIELIN, E

ART UNIT

PAPER NUMBER

2813

DATE MAILED:

10/04/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application N .

09/603,147

Applicant(s)

MOORE ET AL.

Examiner

Erik Kielin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 January 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 60-86 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 60-86 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3,5. 6) ☐ Other: _____

DETAILED ACTION

Specification

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 60-63 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for an etch stop layer or sidewall spacers, does not reasonably provide enablement for any layer in any semiconductor device. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. The specification only indicates that the carbon-containing material is to be used as an etch stop material or side wall spacers, not as any construction in any semiconductor device. Therefore, the claims extend beyond the scope of the specification.

3. Claims 85 and 86 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for carbon-containing materials comprising silicon and oxygen or silicon and nitrogen, does not reasonably provide enablement for materials containing

silicon, oxygen, and nitrogen, or silicon, nitrogen, oxygen, and carbon. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make or use the invention commensurate in scope with these claims. Applicant does not provide for formation of an etch stop layer containing silicon, nitrogen, and oxygen, or silicon, nitrogen, oxygen, and carbon. The specification, instead, only refers to carbon incorporation into silicon oxide or silicon nitride.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

2. Claims 60-63 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by US 5,935,873 (**Spuler et al.**). See col. 2, ll. 40-55.

3. Claims 60 and 62 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by JP 10-223758 (**Nobuhisa**). See Abstract.

4. Claims 60 and 62 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by US 6,136,700 (**McAnally et al.**). See Abstract.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 68, 69, 74, 75, and 76-79, 82 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art (**AAPA**) in view of US 5,935,873 (**Spuler et al.**).

The **AAPA** clearly discloses each of the features of forming the DRAM including the three nodes 14, 16, 18 in gated electrical connection via wordlines 20, 22 with sidewalls 28, 30; capacitor constructions 36, 38; bit line contact 46; the etch stop 32 proximate the wordlines and contacting a portion of the storage node. The capacitor construction comprises the storage node, dielectric and second electrode. The wordline comprises a conductive gate with sidewalls. (See Prior Art Figures 1-4 and specification, section entitled, Background of Invention" -- especially pp. 5-8.)

Spuler teaches the benefits of forming an etch stop layer 22 comprising carbon, specifically carbon-doped silicon nitride by using known deposition methods or by implantation of carbon into silicon nitride to provide good etch selectivity when an oxide layer 30 is deposited thereover. (See col. 2, l. 39 to col. 3, l. 35.) The carbon content is 1% to 50% -preferably 10-30%.

It would have been obvious to one of ordinary skill at the time of the invention to use the etch stop layer of **Spuler** in the **AAPA** production for the reasons in **Spuler** or, more

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specifically, that the carbon-doped silicon nitride in the etch stop layer provides better etch selectivity relative to oxides than silicon nitride alone, as is also taught also by the instant specification.

Regarding claim 79, **Spuler** also teaches forming the etch stop 22 adjacent the gate (wordline) structure 12, 14, 16 (col. 2, ll. 8-24) which inherently serve as sidewall spacers. It would have been obvious to one of ordinary skill at the time of the invention to form the etch stop adjacent the wordlines in order to provide protection to the gate structure during etching, as this is desired in both **Spuler** and in the **AAPA**.

7. Claims **68**, 70-75 and **76-78**, 81, 83-86 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art (**AAPA**) in view of JP 10-223758 (**Nobuhisa**).

AAPA, as indicated above, teaches all of the features of the claims except for the indicating that the etch stop layer comprises silicon, oxygen, and carbon (claim 53) or silicon, oxygen, nitrogen, and carbon.

Nobuhisa teaches the benefits of forming an etch stop layer 20 comprising at least one of (1) silicon carbide (2) silicon, carbon, oxygen, and (3) silicon, carbon, oxygen, and nitrogen by implanting carbon and/or nitrogen into silicon dioxide layer 4b. Note that although, **Nobuhisa** teaches that SiC or SiCN is formed, it is held absent evidence to the contrary that oxygen is necessarily present because the carbon and nitrogen are implanted into silicon dioxide. (See paragraphs [0036]-[0039] and especially [0053] which states that both carbon and nitrogen are implanted; Figs. 4-6.)

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It would have been obvious to one of ordinary skill at the time of the invention to form the etch stop with the materials taught by **Nobuhisa** for the reasons in **Nobuhisa**, specifically to form an etch resistant etch stop layer relative to silicon dioxide.

8. Claims **64**, **66**, **67**, and **68**, **70-75**, and **76-81**, **83-84** are rejected under 35 U.S.C. 103(a) as being unpatentable over **AAPA** in view of **McAnally**.

The **AAPA** discloses all of the features of the instant invention, as noted above, except for indicating that the etch stop layer or sidewalls comprise (1) a material having carbon, (2)silicon carbide, (3) a material having carbon, silicon, and oxygen, (4) a material having carbon, silicon, and nitrogen.

McAnally teaches forming either or both the sidewalls 108 and etch stop 110 from the aforementioned compositions containing carbon to improve etch selectivity (Abstract, col. 3, ll. 37-40; claim 3; col. 5, ll. 10-43). It would have been obvious to one of ordinary skill at the time of the invention was made to use the etch stop of **McAnally** for the reasons indicated therein.

Then regarding claim 64, the thickness of the sidewall is not taught to be less than or equal to 500 angstroms. The selection of the sidewall thickness is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious). It would have been obvious to one of ordinary skill at the time of the invention to choose the sidewall thickness in order to optimize the sidewalls relative to the device being formed.

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9. Claims 61, 63, 65, 69, and 82 are rejected under 35 U.S.C. 103(a) as being unpatentable over **AAPA** in view of **McAnally** as applied to claims 76-81, 83-84 above, and further in view of **Spuler**.

The **AAPA** in view of **McAnally** teaches each of the features of the instant invention except for the etch resistant material having Applicant's specified amount of 2% to 20% carbon by weight.

McAnally teaches the appropriate amount of carbon in an etch resistant material for providing good selectivity relative to non-carbon containing dielectric materials is 1 to 50% or preferably 10% to 30%.

It would have been obvious to one of ordinary skill at the time of the invention was made to use the amount of carbon suggested in **Spuler** for the carbon resistant material taught in **McAnally** for the reasons indicated in **Spuler** and because **McAnally** is not limitative to any amount of carbon.

Further in this regard, although the carbon quantity is not exactly as claimed by Applicant, overlapping ranges are *prima facie* obvious in the absence of unexpected results. See In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious). The choice is obvious to optimize the amount of carbon to provided the best etch selectivity relative to a non-carbon-containing dielectric, according to precedent and the teachings of **McAnally** and **Spuler**.

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Double Patenting

10. Claims 70, 72, and 73 are objected to as being substantial duplicates (claims 70 and 72 are exact duplicates). Similarly, claims 60 and 62, claims 74 and 75, claims 83 and 84, and claims 85 and 86 are substantial duplicates. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

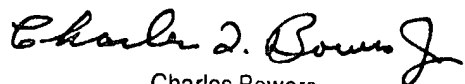
US 6,187,672 B1 (**Zhao** et al., col. 7, ll. 5-32) and US 6,171,971 B1 (**Natzle**, col. 6, ll. 1-15) and US 6,091,081 (**Matsubara** et al., col. 6, ll. 25-33) each teach forming an carbon etch stop (called "protective layer" in Zhao) to provide etch selectivity relative to silicon dioxide.

Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached at (703) 308-2417 or by e-mail at charles.bowers@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.


EK

September 14, 2001


Charles Bowers
Supervisor Patent Examiner
Technology Center 2800